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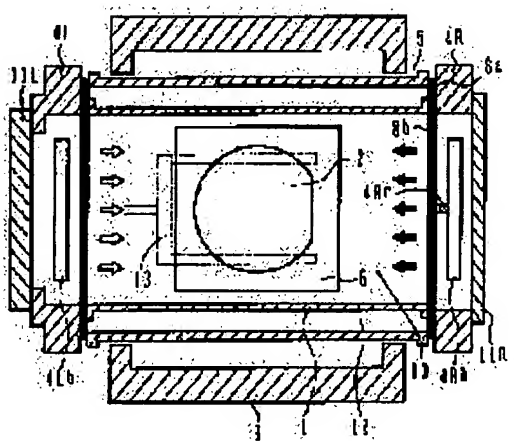
(54) SEMICONDUCTOR PROCESSOR AND USING METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a semiconductor processor, which can improve a device operation rate by suppressing the strength of a reaction pipe from being lowered by gas cleaning or the like.

SOLUTION: In a CVD device, a semiconductor wafer 2 is heated by a heater, while being housed inside an almost flat reaction pipe 1 equipped with openings at both its terminals in a longitudinal direction, gases for treatment are exhausted through a gas exhaust hole 4Rb (or 4Lb) of flange 4R (or 4L), while being supplied through a gas supply hole 4La (or 4Ra) of a flange 4L (or 4R) into the reaction pipe 1, and deposition on the surface of the wafer 2 can be performed. In such a case, this CVD device forms a double pipe structure, together with the reaction pipe 1 by providing a protection pipe 5 surrounding the outer peripheral side of reaction pipe 1 over almost the full length of reaction pipe 1 in the longitudinal direction.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] abbreviation which prepared opening in longitudinal direction both ends -- the semi-conductor processor characterized by to have formed the protecting tube which encloses the periphery side of said coil covering the longitudinal direction abbreviation overall length of this coil in the semi-conductor processor which performs thin film formation on said semi-conductor wafer front face, or epitaxial growth by exhausting containing and heating a semi-conductor wafer inside a flat coil, and supplying the gas for processing within [said] a reaction, and to form double pipe structure with said coil.
[Claim 2] The semi-conductor processor characterized by establishing the pressure control means which controls the pressure of the opening room formed between said coils and said protecting tubes in a semi-conductor processor according to claim 1.
[Claim 3] abbreviation which prepared opening in longitudinal direction both ends -- by exhausting containing and heating a semi-conductor wafer inside a flat coil, and supplying reactant gas within [said] a reaction In the semi-conductor processor which performs thin film formation on said semi-conductor wafer front face, or epitaxial growth The semi-conductor processor characterized by having the pressure control means which controls the pressure of the opening room formed between the protecting tube arranged so that the periphery side of said coil may be surrounded, and this protecting tube and said coil.
[Claim 4] It is the semi-conductor processor characterized by the thing on which, as for said pressure control means, the pressure within [said] a reaction, abbreviation, etc. spread the pressure of said opening room in a semi-conductor processor according to claim 2 or 3, and which is controlled to become.
[Claim 5] The semiconductor device characterized by forming said at least one film using a semi-conductor processor according to claim 1 or 3 in the semiconductor device equipped with at least one film among Si3N4 film for the oxide film and the Lynn glass membrane for the polish recon film of gate electrode wiring, the phosphorus dope polysilicon contest film, and layer insulation, and a capacitor insulation.

[Translation done.]

- exhausting
- heating
- supply reactant gas

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the semiconductor device manufactured using the semi-conductor processor which adhesion deposition of a reaction by-product may produce in a reaction tube wall side especially, and its equipment with respect to the semi-conductor processor used in order to perform circuit creation to a wafer for example, in a semi-conductor manufacture process.
[0002]
[Description of the Prior Art] As an example of the conventional semi-conductor processor, the heat CVD system which is membrane formation equipment for creating a circuit is in a semi-conductor wafer. As a well-known technical example about this heat CVD system, the heat CVD system of a publication is in JP,7-94419,A. This heat CVD system has structure which attached the gate valve of the metal which takes a wafer in and out of opening which is called the so-called hot wall type sheet CVD system, formed the flat coil which consists of ingredients, such as a quartz, in the heating space formed at the parallel monotonous heater of two sheets, and was prepared in the longitudinal direction both ends of that coil, and the flange which performs installation and exhaust air of the material gas to a coil.
[0003] In the heat CVD system of the above-mentioned configuration, if the membrane formation to a semi-conductor wafer is repeated, a reaction by-product will accumulate on the wall surface of a coil gradually. If the thickness of this deposition film exceeds an allowed value, telescopic motion, vibration, etc. of the deposition film by the temperature change will become a cause, and it will come to separate from the wall surface of a reaction container rapidly. And this deposition film that separated serves as minute dust, falls and comes to adhere to the front face of a semi-conductor wafer. Since adhesion of this minute dust becomes an open circuit of semiconductor device circuit wiring and the cause of a short circuit, when such a phenomenon happens, it must suspend equipment, and must clean the inside of a reaction container. Therefore, the equipment operating ratio and yield of a manufacture process of a semiconductor device fall sharply. This is technically difficult, although it is most effective to reduce the amount of generation of the reaction by-product deposited on the wall surface of the coil of a reaction container in order to prevent this. Then, adhesion of minute dust to a semi-conductor wafer is prevented by making a reaction by-product usually deposit on a reaction tube wall side as film which cannot separate as easily as possible, and removing by gas cleaning (namely, etching) or drug solution washing, before they separate and fall.
[0004]
[Problem(s) to be Solved by the Invention] In order to use the heat CVD system by the above-mentioned well-known technique with the mass-production production line of a semiconductor device after securing an equipment operating ratio and the yield, as mentioned above, it is indispensable to a reaction tube wall side to remove periodically the reaction by-product made to adhere as deposition film by approaches, such as gas cleaning and drug solution washing.
[0005] However, if it carries out by doing in this way and repeating removal of the deposition film, a minute crack (micro crack) may occur in the internal surface of the coil manufactured with the quartz

ingredient. Moreover, since the deposition film accumulates on a reaction tube wall side at an ununiformity, even if it performs deposition film removal, the deposition film may remain partially. On the other hand, in the CVD system of the above-mentioned well-known technique, while the pressure of a maximum of 0.1 MPa (one atmospheric pressure) by atmospheric pressure is always added to a coil, the thermal stress which originates in a coil during membrane formation at temperature distribution occurs. By existence with such a pressure and thermal stress, the crack of a coil may arise from the minute crack part mentioned above, or the membrane stress by the residual deposition film may occur. Therefore, it becomes difficult to prevent the fall of a coil on the strength, comparatively, within the short period of time, it cannot but stop having exchanged coils and the availability of the equipment in a semiconductor device production process was reduced.

[0006] This invention solves the technical problem of the above-mentioned conventional technique, controls the fall of the coil by gas cleaning etc. on the strength, and is to offer the semi-conductor processor and semiconductor device which can raise equipment availability.

[0007]

[Means for Solving the Problem]

In order to attain the above-mentioned purpose, (1) This invention abbreviation which prepared opening in longitudinal direction both ends -- by exhausting containing and heating a semi-conductor wafer inside a flat coil, and supplying the gas for processing within [said] a reaction In the semi-conductor processor which performs thin film formation on said semi-conductor wafer front face, or epitaxial growth, the protecting tube which encloses the periphery side of said coil covering the longitudinal direction abbreviation overall length of this coil is formed, and double pipe structure is formed with said coil. In the time of membrane formation, the thin film by the reaction by-product accumulates on a coil. Therefore, it will be necessary to repeat coil washing by gas cleaning etc. and to perform it, and a minute crack and the partial residual deposition film will exist in a reaction tube wall side. However, a coil and the protecting tube can prevent that the atmospheric pressure of a maximum of 0.1 MPa joins the periphery of a coil directly, if the pressure in the opening room (outside annular space of double pipe structure) formed between a coil and the protecting tube by forming double pipe structure is maintained somewhat low using a pressure control means. Therefore, since the force of joining a coil turns into only thermal stress resulting from the temperature distribution at the time of heating at the time of membrane formation, even if a minute crack and the residual deposition film exist, the fall of the coil by generating of a crack or membrane stress on the strength stops being able to happen easily. That is, the exchange period of the part coil can be extended. On the other hand, a maximum of 0.1 MPa atmospheric pressure and the thermal stress resulting from the temperature distribution at the time of heating membrane formation join the protecting tube from inside and outside. However, since this protecting tube is not put to the gas for processing, the film does not deposit it on an internal surface and its tubing washing by gas cleaning etc. is unnecessary. Therefore, since the fall on the strength by the minute crack or existence of the residual deposition film is not generated, an exchange period is long. Since a coil and the protecting tube can lengthen an exchange period as mentioned above, it can become usable stably [over a long period of time] about a semi-conductor processor, and the equipment availability in a semiconductor device production process can be raised.

[0008] (2) Establish the pressure control means which controls preferably the pressure of the opening room formed between said coils and said protecting tubes in the above (1).

[0009] In order to attain the above-mentioned purpose, (3) Moreover, this invention abbreviation which prepared opening in longitudinal direction both ends -- by exhausting containing and heating a semi-conductor wafer inside a flat coil, and supplying reactant gas within [said] a reaction In the semi-conductor processor which performs thin film formation on said semi-conductor wafer front face, or epitaxial growth, it has the pressure control means which controls the pressure of the opening room formed between the protecting tube arranged so that the periphery side of said coil may be surrounded, and this protecting tube and said coil.

[0010] (4) Control said pressure control means preferably in the above (2) or (3) for the pressure within [said] a reaction, abbreviation, etc. to spread the pressure of said opening room, and to become.

[0011] (5) Moreover, in order to attain the above-mentioned purpose, this invention forms said at least one film using a semi-conductor processor according to claim 1 or 3 in the semiconductor device equipped with at least one film among Si3N4 film for the oxide film and the Lynn glass membrane for the polish recon film of gate electrode wiring, the phosphorus dope polysilicon contest film, and layer insulation, and a capacitor insulation.

[0012]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained, referring to a drawing. This operation gestalt is an operation gestalt of a hot wall type sheet CVD system.

[0013] The plot plan which expresses first the whole CVD system configuration in which the CVD system by this operation gestalt is formed is shown in drawing 2 . In this drawing 2 , the CVD system consists of cassette rooms 104,104 of 103,103 or 2 cooling rooms of two reaction chambers [102,102 or 2] centering on the conveyance room 101. In the above-mentioned configuration, the wafer beforehand arranged in the cassette room 104 is first introduced in a reaction chamber 102 using the fork for conveyance in the conveyance room 101 (not shown), and thin film formation (suitably henceforth membrane formation) is performed. And after membrane formation processing was completed in the reaction chamber 102, a wafer is taken out from a reaction chamber 102 and the wafer is cooled in a cooling room 103, it is returned to the cassette room 104.

[0014] The CVD system by this operation gestalt is arranged in the reaction chamber 102 of the above-mentioned configuration, respectively, and performs membrane formation processing. Hereafter, the detail structure is explained using drawing 1 - drawing 9 . Drawing 1 is a horizontal sectional view showing the important section structure of the CVD system by this operation gestalt, and drawing 3 is the sectional side elevation of the structure shown in drawing 1 . In drawing 1 and drawing 3 , the CVD system by this operation gestalt Contain the semi-conductor wafer 2 inside the flat coil 1, and it heats at a heater 3. abbreviation which prepared opening in longitudinal direction both ends -- By exhausting through flueing hole 4Rb (or 4Lb(s)) of flange 4R (or 4L), membrane formation to wafer 2 front face is performed, supplying the gas for processing in a coil 1 through gas supply hole 4La (or 4Ra) of flange 4L (or 4R). Moreover, at this time, this CVD system forms the protecting tube 5 which encloses the periphery side of a coil 1 covering the longitudinal direction abbreviation overall length of a coil 1, and forms double pipe structure with the coil 1.

[0015] a coil 1 consists of quartz ingredients -- having -- ** and a cross-section configuration -- abbreviation -- it has a flat rectangle. Moreover, this coil 1 levels the axis of a longitudinal direction mostly, and is arranged, and the wafer support plate 6 of the rectangle for laying a wafer 2 in that interior is arranged almost horizontally vertical two-layer one. Installation of one wafer 2 is attained at each wafer support plate 6, respectively, and the membrane formation processing to coincidence is possible for one sheet or two wafers 2 as the whole equipment. In addition, this wafer support plate 6 serves as a configuration which cut and lacked the field which fork 13 moves as shown in drawing 1 (after-mentioned). the abbreviation as a coil 1 with the cross-section configuration same [the protecting tube 5] on the other hand -- it has a flat rectangle, and the axis of a longitudinal direction is leveled mostly and it is arranged. Moreover, opening is formed in those longitudinal direction both ends by this protecting tube 5 like the coil 1. And both-ends opening of these protecting tubes 5 and a coil 1 is combined with Flanges 4L and 4R through O rings 8a and 8b for seals, respectively.

[0016] The heater 3 is equipped with the abbreviation plate-like configuration, it is arranged so that the upper and lower sides of the protecting tube 5 may be countered on both sides of a coil 1 and the protecting tube 5, and it forms the heating furnace. Moreover, this heater 3 has structure divided into plurality, and each calorific value is adjusted by the heating control means which is not illustrated so that the temperature distribution of a wafer 2 may become homogeneity. The heat insulator 9 is formed in the periphery side of this heater 3, and the heat dissipation to a perimeter is reduced, and it is considered so that power consumption can be reduced.

[0017] In the thickness of Flanges 4L and 4R, gas supply hole 4La of Flanges 4L and 4R and 4Ra are directions perpendicular to the axis of a coil 1, and are formed toward the upper part, and introduce the gas for processing (namely, membrane formation gas, cleaning gas, and a detail after-mentioned) into

the reaction chamber 10 formed in a coil 1. the same -- the direction where flueing hole 4Lb and 4Rb are perpendicular to the axis of a coil 1 -- and it goes caudad, and it is formed and the gas for processing is exhausted from a reaction chamber 10. Moreover, gate valves 11L and 11R are combined with the shaft-orientations outside of Flanges 4L and 4R so that it may be made main opening formed in the flanges 4L and 4R for the time being. Furthermore, gas supply hole 4Lc for supplying gas is formed in the opening room 12 (outside annular space of double pipe structure) which is formed between a coil 1 and the protecting tube 5, and is divided into flange 4L with Flanges 4L and 4b in both ends, and flueing hole 4Rc for exhausting gas from the opening room 12 is formed in flange 4R.

[0018] The explanatory view showing the configuration which performs above-mentioned drawing 1 and pressure control in the structure of drawing 3 is shown in drawing 4 . In this drawing 4 , it connects with gas supply hole 4La, 4Ra and flueing hole 4Lb, and 4Rb among the structures of above-mentioned drawing 1 and drawing 3 , and the network (suitably henceforth a reaction chamber network) which passes the gas for processing (membrane formation gas and cleaning gas) to the reaction chamber 10 in a coil 1 is equipped with the source 13 of gas, the massflow controller 14, the vacuum pump 15, and the pressure control section 16. Moreover, similarly, it connects with gas supply hole 4Lc and flueing hole 4Rc among the structures of above-mentioned drawing 1 and drawing 3 , and the network (suitably henceforth an opening room network) which passes gas in the opening room 12 between a coil 1 and the protecting tube 5 is equipped with the source 17 of gas, the massflow controller 18, the vacuum pump 19, and the pressure control section 20.

[0019] In a reaction chamber network, the gas drawn from the source 13 of gas flows into a reaction chamber 10 through a massflow controller 14, the change-over bulb 21 (or 22), and gas supply hole 4La (or 4Ra), and flows out of flueing hole 4Lb (or 4Rb(s)) further. then, pass a pressure control valve 23 (or 24) -- it is led to a vacuum pump 19 (refer to a white arrow head or a black arrow head). In addition, although it is determined by closing motion of the change-over bulbs 21 and 22 and pressure control valves 23 and 24 at this time whether to pass gas to the sense of a white arrow head or pass gas to the sense of a black arrow head, this actuation is performed according to the control signal of the pressure control section 16. Moreover, at this time, the pressure of a reaction chamber 10 is detected by the pressure gage 25, and that detecting signal is inputted into the pressure control section 16 (however, this detecting signal is inputted also into the pressure control section 20 of an opening room network). And based on the detecting signal from this pressure gage 25, the pressure control section 16 controls a massflow controller 14, the change-over bulb 21 (or 22), and a pressure control valve 23 (or 24) so that the pressure of a reaction chamber 10 becomes the optimal predetermined value for processing.

[0020] On the other hand, in an opening room network, the gas drawn from the source 17 of gas flows into the opening room 12 through a massflow controller 18 and gas supply hole 4Lc, and flows out of flueing hole 4Rc further. Then, it is led to a vacuum pump 19 through a pressure control valve 26. At this time, the pressure of the opening room 12 is detected by the pressure gage 27, and that detecting signal is inputted into the pressure control section 20. And based on the detecting signal of this pressure gage 27, and the detecting signal from the pressure gage 25 mentioned above, the pressure control section 20 searches for the difference between the pressure of a reaction chamber 10, and the pressure of the opening room 12, and it controls a massflow controller 18 and a pressure control valve 26 so that these become almost equal. In addition, the pressure control section 20, a massflow controller 18, and a pressure control valve 26 constitute the pressure control means on which the pressure in a coil 1, abbreviation, etc. spread the pressure of the opening room 12 formed between a coil 1 and the protecting tube 5 and which is controlled to become among more than.

[0021] Next, the procedure of the membrane formation approach in the above-mentioned configuration is explained. In addition, the following processes are carried out, maintaining this condition, after controlling as a preparation process so that the pressure of a reaction chamber 10 and the pressure of the opening room 12 become almost equal by the pressure control section 20 beforehand. First, one gate valve 11L (or it is the same as that of 11R and the following) is opened wide, one sheet or two wafers 2 are put on fork 13, and it inserts in the interior of a coil 1 in the level condition through gate valve 11L. And after moving the inserted wafer 2 from fork 13 to the wafer support plate 6, fork 13 is drawn out

and gate valve 11L is shut. Then, while supplying the membrane formation gas which adjusted the pressure by the pressure control section 16 from gas supply hole 4La (or 4Ra) at the same time it heats the laid wafer 2 at a heater 3 On both sides of the side and wafer 2 with which membrane formation gas is supplied, it exhausts from flueing hole 4Rb (or 4Lb(s)) of the opposite side, and membrane formation gas is passed on the front face of a wafer 2 like a ****** arrow head (or black arrow head) almost in parallel. Thereby, it is made the temperature (for example, 1200 degrees C or less) and the pressure (for example, severalPa- 0.1 MPa) of a request of the inside of a coil 1, and membranes are formed by thermal reaction on the front face of a wafer 2. If membrane formation processing is completed, after opening gate valve 11L wide again, inserting fork 13 in the interior of a coil 1 through this and moving a wafer 2 from a support plate 6 to fork 13, fork 13 is drawn out and a wafer 2 is picked out from a coil 1.

[0022] By the way, if the membrane formation processing to the above wafers 2 is repeated, gradually, the film formed by the front face of a wafer 2 and the film (reaction by-product) of the same kind will accumulate on an ununiformity, and will go to the internal surface of a coil 1. If this wall surface deposition film exceeds an allowed value, telescopic motion, vibration, etc. of the deposition film by the temperature change will become a cause, and it will come to separate from a wall surface rapidly. And it becomes minute dust, and this film that separated falls and comes to adhere to the front face of a wafer 2 as a foreign matter. Although adhesion of this minute dust must suspend a CVD system and must clean the inside of a coil 1 when such a phenomenon happens since it becomes an open circuit of semiconductor device circuit wiring and the factor of a short circuit, the sharp decline in the yield of the manufacture process of a semiconductor device or an equipment operating ratio is caused by this. Then, in order to prevent decline in this yield and equipment availability, adhesion of minute dust to a wafer 2 is prevented by making the wall surface of a coil 1 deposit the deposition film as film which cannot separate as easily as possible, and removing in gas cleaning (namely, etching) etc., before they separate and fall.

[0023] The procedure of this gas cleaning is explained below. In addition, the following processes are carried out, maintaining this condition, after controlling this procedure as well as the above-mentioned membrane formation procedure as a preparation process so that the pressure of a reaction chamber 10 and the pressure of the opening room 12 become almost equal by the pressure control section 20. That is, from gas supply hole 4La (or 4Ra), while supplying cleaning gas (or thing which diluted cleaning gas with the carrier gas of Ar and N2 grade **), on both sides of the side and wafer 2 with which gas is supplied, it exhausts from flueing hole 4Rb (or 4Lb(s)) of the opposite side, and cleaning gas is passed almost in parallel with the front face of a wafer 2. This cleans the wall surface deposition film in a coil 1 by gas thermal reaction etching. The above cleaning procedures are suitably repeated for every predetermined period. In addition, a coil 1 is exchanged for the new coil 1 when the amount of minute crack initiation condition or the residual deposition film exceeds a predetermined control value (however, since extent which these minute cracks and the residual deposition film bring a fall on the strength becomes small so that it may mention later, this control value can become conventionally larger than a value).

[0024] The operation effectiveness of this operation gestalt which are the above-mentioned configuration and actuation is explained below. That is, although gas cleaning etc. is repeated and is performed since a thin film accumulates on a coil 1 in a membrane formation procedure as mentioned above, a minute crack and the partial residual deposition film will exist in coil 1 internal surface by it. However, in this operation gestalt, since a coil 1 and the protecting tube 5 maintain the pressure of the opening room 12 which forms double pipe structure and is formed between a coil 1 and the protecting tube 5 to a low pressure almost equal to a reaction chamber 10 using a pressure control means (the pressure control section 20, a massflow controller 18, and pressure control valve 26), they can prevent that the atmospheric pressure of a maximum of 0.1 MPa joins the periphery of a coil 1 directly. Therefore, since the force of joining a coil 1 turns into only thermal stress resulting from the temperature distribution at the time of heater 3 heating in a membrane formation procedure, even if a minute crack and the residual deposition film exist, the fall of the coil 1 by generating of a crack or membrane stress on the strength stops being able to happen easily. That is, the exchange period of the part coil 1 can be

extended. Specifically, what was the about former, for example, one month, can be extended till about three months. On the other hand, a maximum of 0.1 MPa atmospheric pressure and the thermal stress resulting from the temperature distribution at the time of heating membrane formation join the protecting tube 5. However, since it is not put to membrane formation gas, the film does not deposit this protecting tube 5 on an internal surface, and it does not perform gas cleaning etc. Therefore, since the fall on the strength by the minute crack or existence of the residual deposition film is not generated, an exchange period can be lengthened. Since a coil 1 and the protecting tube 5 can lengthen an exchange period as mentioned above, it can become usable stably [over a long period of time] about a CVD system, and the equipment availability in a semiconductor device production process can be raised. Moreover, since only thermal stress acts on a coil 1 as mentioned above, thickness of a coil 1 can also be made thin in the range which can secure a to some extent long exchange period. In this case, it is effective in the ability to reduce the manufacture cost of coil 1 the very thing. Furthermore, although it may have become difficult to fully clean a coil 1 depending on the case and the yield may have fallen by foreign matter adhesion conventionally for the fall on the strength by the minute crack and the existence of the residual deposition film which were mentioned above, since a fall on the strength is controlled according to this operation gestalt, gas cleaning etc. can always fully be performed to a coil 1. By this, since foreign matter adhesion to the semi-conductor wafer 2 can be reduced certainly, the yield can be improved certainly.

[0025] In addition, in the above-mentioned operation gestalt, although it is the pressure control section 20, a massflow controller 18, and a pressure control valve 26, and it controlled so that the pressure of the opening room 12 and the pressure of a reaction chamber 10 spread abbreviation etc. and became, it is not restricted to this. That is, the pressure of the opening room 12 may be controlled to become the pressure of arbitration [higher than the pressure of a reaction chamber 10 and] lower than atmospheric pressure. The same effectiveness is acquired also in this case.

[0026] Moreover, in the above-mentioned operation gestalt, although the reaction chamber network and the opening room network were separately equipped with vacuum pumps 15 and 19, respectively, as it is not restricted to this, for example, is shown in drawing 5 , and you may draw in with the common vacuum pump 28. [the downstream of pressure control valves 23, 24, and 26] [each exhaust side piping] [connect and] [1] The same effectiveness is acquired also in this case.

[0027] Furthermore, in the above-mentioned operation gestalt, although the configuration of the protecting tube 5 had become a coil 1 and the flattened tube equipped with the same rectangle cross-section configuration, it is not restricted to this. Drawing 6 - drawing 9 explain the modification about the configuration of this protecting tube 5.

(1) The modification of the 1st ******** prepares the rib for reinforcement in the interior of the protecting tube 5. The sectional side elevation of the structure which showed the horizontal sectional view showing the important section structure of this CVD system to drawing 6 at this drawing 6 is shown in drawing 7 . In addition, the same sign is given to the member equivalent to the above-mentioned operation gestalt. As shown in drawing 6 and drawing 7 , in this modification, rib 5A prolonged in the hoop direction perimeter is formed in longitudinal direction two or more parts (five places in this case) of the inner skin of the protecting tube 5. There is effectiveness which raises by this the mechanical strength to the atmospheric pressure force of acting on the skin of the protecting tube 5.

[0028] (2) The modification of the 2nd ******** changes the cross-section configuration of the protecting tube 5. The sectional side elevation of the structure which showed the horizontal sectional view showing the important section structure of this CVD system to drawing 8 at this drawing 8 , and the cross-sectional view (however, a wafer 2 is removed) in an A-A cross section are shown in drawing 9 . In addition, the same sign is given to the member equivalent to the above-mentioned operation gestalt. As shown in drawing 8 and drawing 9 , in this modification, the cross-section configuration of the protecting tube 5 serves as an abbreviation ellipse. There is effectiveness which raises the mechanical strength to the atmospheric pressure force of acting on the skin of the protecting tube 5, by this as well as the above (1). Moreover, although making a cross-section configuration into a perfect circle form is also considered in order to raise this mechanical strength, it is effective in the ability to

miniaturize the whole equipment by considering as an ellipse form like this modification.
[0029] Moreover, although the above-mentioned operation gestalt was an operation gestalt of a sheet CVD system, it is not restricted to this, but may apply the concept of this invention to other CVD systems, and acquires the same effectiveness also in this case. Moreover, the candidate for application of this invention may be applied to other semi-conductor processors, such as an epitaxial growth system which makes epitaxial growth perform on the front face of not only a CVD system but the wafer 2, and acquires the same effectiveness also in these cases.
[0030] Furthermore, there is a semiconductor device equipped with Si3N4 film for the oxide film and the Lynn glass membrane for the polish recon film of gate electrode wiring manufactured using the CVD system of the above-mentioned operation gestalt as other operation gestalten, the phosphorus dope polysilicon contest film, and an interlayer insulation film, and a capacitor insulation etc., and adhesion of dust to a wafer 2 can secure very little good quality in this case.
[0031]
[Effect of the Invention] According to this invention, since a coil and the protecting tube can lengthen an exchange period, it can become usable stably [over a long period of time] about a semi-conductor processor, and the equipment availability in a semiconductor device production process can be raised. Moreover, since only thermal stress acts on a coil, the thickness can also be made thin in the range which can secure a to some extent long exchange period. In this case, it is effective in the ability to reduce the manufacture cost of the coil itself.

[Translation done.]